A Critical Appraisal of "Effectiveness of a Neuromuscular and Proprioceptive Training Program in Preventing the Incidence of Anterior Cruciate Ligament Injuries in Female Athletes"

By

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Abstract

Over a course of 10 weeks, this term paper was developed, step-by-step, and concluded in this critical appraisal. The idea of evidence-based practice was brought to first year PT students, and this paper is one of the products. The importance and basis of evidence-based practice in the PT profession is only as significant as the critical appraisal of it. Through a Pubmed and PEDro search, this article was chosen to answer for critical appraisal. Its introduction left out a key variable in that it does not state what proprioceptive training is, or what it has to do with the study, but otherwise frames the situation with the rising trend in female athletes participating and ACL injury. There were inherent flaws in the research design due to the scale of the study and the variability in the extent to which the intervention was adhered to. But because of its scale and homogenous demographic, these flaws can be negligible. Results section were clear and presented clinically significant outcomes. The discussion section addressed most of its own weaknesses, and further implicated its importance, and future design. It largely does not address the significance of this study to the clinical setting. Ultimately, the applicability of this study to PT practice is safe, can be effective in preventing musculoskeletal injury, and is significant to the PT profession.

Key words

Proprioception, anterior cruciate ligament (ACL), neuromuscular, training, prevention

Introduction

The physical therapy profession is grounded on evidence-based practice. However, not all evidence backing commonly used intervention is sound, or applicable to all situations. Thus, it is important for student therapists as well as current practicing therapists to be critical of the evidence that grounds the practices used in physical therapy today, and tomorrow. Commonly, patients of all ages will seek out physical therapy after they have sustained a musculoskeletal injury - there are interventions that one can take to decrease the incidence of having an injury in the first place. Is there valid evidence backing these interventions, for example, in adolescents? The clinical question raised: is proprioceptive "prehab" training an effective way to decrease musculoskeletal injury incidence rates in high school adolescents who participate in scholastic sports?

Methods

The databases Pubmed and PEDro were used in this literature search, using the key phrases "proprioceptive training prevention" and "training injury prevention". Furthermore, the articles' types of interest included clinical study, clinical trial, comparative study, and controlled clinical trial. This was to ensure the search only included experimental studies and not reviews or analyses. In addition, the inclusion criteria included only humans from birth-18 years old, because the area of interest is in adolescents playing sports in high school. When these keywords, limiters, and criteria resulted in hits below 50, article review began

The article being appraised is from the American journal of Sports medicine, published in 2005 by Mandelbaum, Silvers, and Watanabe (among others). The data was collected from a Southern California soccer league with collaboration from scientists in California, Georgia, and

North Carolina. The reason this article was chosen for critical appraisal was for its direct answer to the clinical question presented, while also having research flaws that allow for critical appraisal of its validity.

Results

Summary of the study

This non-randomized 2-year study looked to examine the outcome effects of educating and training female soccer players from ages 14-18 with proprioceptive and proper body mechanical techniques to prevent ACL injury. 1041 athletes from 52 teams from the Coast Soccer League of Southern California enrolled the first year for intervention. 844 athletes from 45 teams enrolled in the second year. The 1905 athletes from 95 teams and 1913 athletes from 112 teams (respectively) who did not enroll served as control groups. The intervention group watched a video on a warm up designed to teach proprioceptive skills and proper biomechanics, and the coach attended a safety meeting, and received a supplemental packet on the techqniques. The control group did what their individual coach designated. A self-reported quality assurance form was signed by the intervention group coaches to insure adherence to training, and injury-specific forms were submitted and crosschecked with league databases, and later diagnosed by MRI. In 2000, there was an 88% reduction rate in ACL tears compared to the control group, and in 2001, a reduction of 74%. The study concludes that a neuromuscular training program may decrease the number of ACL injuries in female soccer players.

Appraisal of the study introduction

The introduction's strong point was in its connection of female athletes and ACL injuries. It provided apt information on the rising trend of females participating in sports, and the mechanism and burden of ACL injuries, both of which are critical variables of the study and cited appropriately. Most of the literature included were recent at the time, and from credible journals. Overall, the introduction was well written and flowed understandably.

The main weakness of the introduction was its complete lack of including the concept of proprioception, the mechanism of the intervention of the study – a critical variable that should have been explained to understand the study. A less glaring weakness included a lacking explanation of the demands soccer has on the lower extremity, and how this leads to ACL injuries, which had a brief mention.

Appraisal of the study methods

The strengths of the methods section included an adequate sample size, homogenous characteristics in the subjects, and redundant outcome measures. The subjects were from a Southern California soccer league, indicating subjects have similar sociodemographic and health characteristics. This also allowed for a sample size to allow for any statistical significance. The outcome measures (ACL injury) were screened twice by coach and doctor, and finally checked by MRI, which is the gold standard of diagnosing an ACL injury. This ensures all injuries are valid.

This study was not blinded, causing the researchers to know who received intervention, and potentially the subjects as well, if told by the coach. This indicates there may be bias by outcome assessors or the subjects. The extent of application of the intervention is the main weakness of this study. Since only a video was shown along with a supplemental packet, the

extent to which athletes in the intervention group actually adhered to the intervention is hugely variable. Coaches were made to submit a quality assurance of the intervention application, but little is said about it, and it would be hard to standardize intervention across many different teams and individual athletes. There could be many unaccounted errors that may affect the results inherent to the study design, which also would make the study hard to replicate.

Appraisal of the study results

The results address the research question and hypothesis appropriately. All outcome measures, ACL tears and exposure hours, were reported. Tables and figures are presented clearly with relevant information. A big strength lies in the result, reducing the incidence of ACL injury in the intervention group by a clinically significant amount, based on the rate and sample size.

The results did not follow the same order that the research questions or procedures were presented, which may make it hard to follow. There was also no mention of the minimal clinically important difference, or the number needed to treat in this study.

Appraisal of the study discussion

The authors did not merely repeat the results, and further indicated the meanings of the findings, proposing mechanisms of which the intervention may have affected, such as feedforward information and neuromuscular control. It cited other similar studies from credible journals which have similar results and scope. It addressed many of its weaknesses, did not over conclude their findings, suggested future studies, and addressed its significance to the athletic population.

The study did not address how adherence to intervention is largely variable due to its self-reporting nature. The study also did elaborate much on the clinical implications for the average population, and focused more on athletes.

Discussion

Physical therapists play a large role in the treatment and prevention of musculoskeletal injury. Although ACL injuries do not account for or represent all musculoskeletal injuries, ACL injuries are very common things for physical therapists to examine. Thus, a study looking at interventions to prevent ACL injuries from occurring is invaluable for the field of physical therapy. This study answers my question directly using a specific type of musculoskeletal injury (ACL) and looks at the incidence of that injury after educating the subjects (who fall under my area of interest) of proprioception and proper biomechanics.

Despite a few doubts in the research design, the results and the benefits conferred have them outweighed. Based on the results, a significant number of patients would not need therapy and would not sustain ACL injury. Injury incidence rates didn't go up in the intervention group, the exercise list appears safe, a therapist can be taught how to teach it properly, and it can be standardized when a PT becomes proficient at teaching the program. In the worst case, there may be no effect if the program was included in a prehabilitation PT program, best case being that a patient may avoid a future ACL injury.

Although there are a few inherent research flaws, ultimately it would seem these flaws may become moot points due to the sheer number of subjects, their homogenous characteristics, and redundant outcome measures. Thus, I have enough confidence in the research validity to consider using this evidence with future patients/clients. As said before, the results were

clinically significant, and unless they were grossly fabricated, they do indicate the intervention has some positive effect on the outcome of ACL injuries. One could safely implement the intervention safely and efficiently because the program does not have any extremely difficult or dangerous tasks, and does not require any expensive equipment. It has many exercises that an athlete would commonly have knowledge on, and a therapist would be able to instruct the exercises to an average patient given enough experience.

Long-lasting and big studies normally have inherent research design flaws. It is still necessary to question whether these flaws actually cast shadow on the validity of these study's conclusions. How much did individual soccer players actually benefit from warming up with this program? Did the intervention just draw athletes from teams that focus more on safety in the first place? Being, from Southern California, and playing scholastic soccer can indicate a higher socioeconomic demographic. Can we even apply these conclusions to other populations, for example, soccer players from impoverished nations, or an older adult looking to get back into sports? Is this even applicable to other musculoskeletal injuries? This study may form the basis of further studies and of practices in PT to prevent musculoskeletal injury today, so it is important to understand and know where exactly an intervention came from and whether you should decide to practice it.

I chose this article because the results were promising for my question, while having flaws to allow me to practice critical appraisal skills. I also wanted to actually see if prehabilitation in PT was valid and based on evidence. Based solely on this study, I think proprioceptive "prehab" training can be an effective way to decrease musculoskeletal injury incidence rates. However, I realize the limitations of applying this study to my research question, as not all musculoskeletal

are similar to the mechanisms of an ACL injury. Thus, I must continue to look through the literature on other types injuries to further my critical appraisal skills.